PATENT ABSTRACTS OF JAPAN

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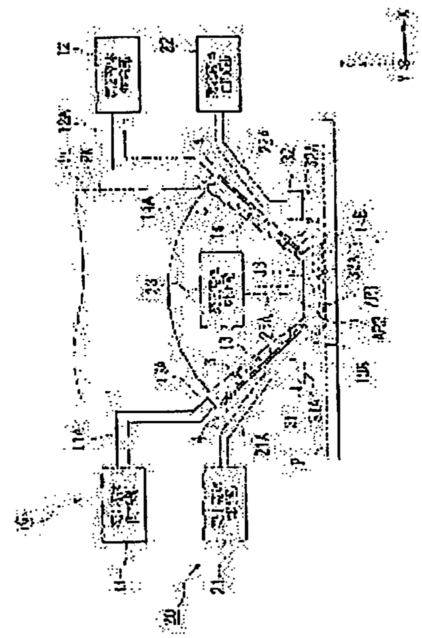
(54) ALIGNER AND DEVICE MANUFACTURING METHOD

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an aligner which can suppress a decline in pattern transferring accuracy caused by the temperature change of liquid when carrying out exposure, with a liquid immersion area formed between a projection optical system and a substrate.
SOLUTION: In the aligner EX, the liquid immersion area AR2 is formed on part of the substrate P including a projection region AR1 of the projection optical system PL. A pattern image is projected on the substrate P via the liquid 1 located between the projection optical system PL and the substrate P, and then a plurality of shot areas of the substrate P are exposed one by one. In order to form the liquid immersion region AR2, the aligner EX is equipped with a liquid supply mechanism 10 which supplies the liquid 1 to the substrate P at least down a side face 3 near the head of the projection optical system PL.



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* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1]
In the aligner which forms an immersion field in the part on a substrate including the projection field of projection optics, projects a pattern image on said substrate through the liquid and said projection optics between said projection optics and said substrates, and carries out sequential exposure of two or more shot fields of said substrate,
The aligner characterized by having the liquid feeder style of said projection optics which is transmitted to the side face near a tip at least, and supplies a liquid on said substrate in order to form said immersion field.
[Claim 2]
Said liquid feeder style is an aligner according to claim 1 characterized by having the guide plate arranged so that said side face may be met, pouring said liquid between said side faces and said guide plates, and supplying a liquid on said substrate.
[Claim 3]
The aligner according to claim 1 or 2 characterized by having further the liquid recovery device in which the liquids on said substrate are collected in parallel to supply of said liquid.
[Claim 4]
Said liquid recovery device is an aligner according to claim 3 characterized by collecting the liquids on said substrate so that it may not go into said projection field, when the liquid used when the 1st shot field was exposed exposes the next 2nd shot field.
[Claim 5]
In the aligner which forms an immersion field in the part on a substrate including the projection field of projection optics, projects a pattern image on said substrate through the liquid and said projection optics between said projection optics and said substrates, and carries out sequential exposure of two or more shot fields of said substrate,
The liquid feeder style which supplies a liquid on said substrate in order to form said immersion field,
The aligner characterized by having the liquid recovery device in which the liquids on said substrate are collected so that it may not go into said projection field, when the liquid used when exposing the 1st shot field on said substrate exposes the 2nd shot field.
[Claim 6]
It is the aligner according to claim 4 or 5 which said 2nd shot field is close in the predetermined direction of said 1st shot field, and is characterized by said liquid recovery device performing liquid recovery on said substrate in the location left in the predetermined direction to said projection field.
[Claim 7]
Said liquid recovery device is an aligner according to claim 6 characterized by performing liquid recovery on said substrate to said projection field in the location distant in said predetermined direction and the direction which intersects perpendicularly.
[Claim 8]
Said liquid recovery device is an aligner according to claim 4 or 5 characterized by collecting the liquids used at the time of exposure of said 1st shot field during stepping migration of said substrate after exposure termination of said 1st shot field.
[Claim 9]
Said liquid recovery device is an aligner according to claim 8 characterized by collecting the liquids used during exposure of said 2nd shot field at the time of exposure of said 1st shot field.
[Claim 10]
Said liquid feeder style is an aligner of claim 4-9 given in any 1 term with which after exposure termination of said 1st shot field is characterized by continuing the liquid supply from the same liquid feed hopper as under exposure to said 1st shot field.
[Claim 11]
Said liquid feeder style is an aligner according to claim 10 characterized by continuing said liquid supply on both sides of said projection field.
[Claim 12]
Each of two or more shot fields on said substrate is exposed moving said substrate to a predetermined scanning direction to said projection field where said pattern image is projected,
Said liquid feeder style is an aligner according to claim 11 characterized by continuing said liquid supply on both sides of said projection field about said scanning direction.
[Claim 13]
Each of two or more shot fields on said substrate is exposed moving said substrate to a predetermined scanning direction to said projection field where said pattern image is projected,
Said liquid recovery device is the aligner of claim 3-12 characterized by having liquid recovery opening which has been left and arranged in the non-scanning direction which intersects said scanning direction to said projection field, and which is prolonged in said non-scanning direction given in any 1 term.

[Claim 14]
In the aligner which carries out sequential exposure of each of two or more shot fields on said substrate by moving said substrate to a predetermined scanning direction to said projection field while forming an immersion field in the part on a substrate including the projection field of projection optics and projecting a pattern image into said projection field through the liquid and said projection optics between said projection optics and said substrates,
The liquid feeder style which supplies a liquid on said substrate in order to form said immersion field,
It has the liquid recovery device in which the liquids on said substrate are collected in parallel to supply of said liquid,
Said liquid recovery device is an aligner characterized by having liquid recovery opening which has been left and arranged in the non-scanning direction which intersects said scanning direction to said projection field, and which is prolonged in said non-scanning direction.
[Claim 15]
In order to adjust the physical relationship on the image surface in which said pattern image is formed, and said front face of a substrate, it has further the detection system which detects the field positional information on said front face of a substrate,
Each of two or more shot fields on said substrate is exposed moving said substrate to a predetermined scanning direction to said projection field where said pattern image is projected,
Said liquid recovery device collects the liquids on said substrate in the recovery location left to the scanning direction to said projection field,
Said detection system is the aligner of claim 3-14 characterized by detecting said field positional information between said projection fields and said recovery locations given in any 1 term.
[Claim 16]
In the aligner which carries out sequential exposure of each of two or more shot fields on said substrate by moving said substrate to a predetermined scanning direction to said projection field while forming an immersion field in the part on a substrate including the projection field of projection optics and projecting a pattern image into said projection field through the liquid and said projection optics between said projection optics and said substrates,
The liquid feeder style which supplies a liquid on said substrate in order to form said immersion field,
The liquid recovery device in which the liquids on said substrate are collected in parallel to supply of said liquid in the recovery location left to said scanning direction to said projection field,
In order to adjust the physical relationship on the image surface in which said pattern image is formed, and said front face of a substrate, it has the detection system which detects the field positional information on said front face of a substrate,

Said detection system is an aligner characterized by detecting said field positional information between said projection fields and said recovery locations.
[Claim 17]
Said liquid recovery device equips the non-scanning direction which intersects said scanning direction with liquid recovery opening which has predetermined die length,
Said liquid recovery opening is an aligner according to claim 15 or 16 characterized by being arranged about said scanning direction at the both sides of said projection field.
[Claim 18]
Each of two or more shot fields on said substrate is exposed moving said substrate to a predetermined scanning direction to said projection field where said pattern image is projected,
Said liquid feeder style is the aligner of claim 1-17 characterized by supplying a liquid to coincidence on both sides of said projection field given in any 1 term about a direction parallel to said scanning direction.
[Claim 19]
Said liquid feeder style is an aligner according to claim 18 it is supposed that is characterized by supplying the liquid of tales doses to coincidence from the both sides of said projection field.
[Claim 20]
The aligner according to claim 18 characterized by the amount of liquids supplied from the one side of said projection field during scan exposure of one shot field on said substrate differing from the amount of liquids supplied from the other side.
[Claim 21]
The device manufacture approach characterized by using the aligner of claim 1 - claim 20 given in any 1 term.

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]
This invention relates to the aligner and the device manufacture approach of exposing a pattern to a substrate, where an immersion field is formed between projection optics and a substrate.
[0002]
[Description of the Prior Art]
A semiconductor device and a liquid crystal display device are manufactured by the technique of the so-called photolithography which imprints the pattern formed on the mask on a photosensitive substrate. The aligner used at this photolithography process has the mask stage which supports a mask, and the substrate stage which supports a substrate, and it imprints the pattern of a mask to a substrate through projection optics, moving serially on a mask stage and a substrate stage. Since it corresponds to much more high integration of a device pattern in recent years, the further high resolution-ization of projection optics is desired. The resolution of projection optics becomes so high that the numerical aperture of projection optics is so large that the exposure wavelength to be used is short. Therefore, exposure wavelength used with an aligner is short-wavelength-ized every year, and the numerical aperture of projection optics is also increasing. And although the exposure wavelength of the current mainstream is 248nm of KrF excimer laser, no less than 193nm of the ArF excimer laser of short wavelength is being put further in practical use. Moreover, in case it exposes, the depth of focus (DOF) as well as resolution becomes important. Resolution R and the depth of focus delta are expressed with the following formulas, respectively.
R=k1 and lambda/NA -- (1)
delta=**k2 and lambda/NA 2 -- (2)
Here, the numerical aperture of projection optics, and k1 and k2 is [lambda of exposure wavelength and NA] process multipliers. (1) In order to raise resolution R, when exposure wavelength lambda is shortened and numerical aperture NA is enlarged from a formula and (2) types, it turns out that the depth of focus delta becomes narrow.
[0003]
When the depth of focus delta becomes narrow too much, it becomes difficult to make a substrate front face agree to the image surface of projection optics, and there is a possibility that the margins at the time of exposure actuation may run short. Then, the immersion method which considers as the approach of shortening exposure wavelength substantially and making the depth of focus large, for example, is indicated by the following patent reference 1 is proposed. This immersion method expands the depth of focus by about n times while it improves resolution using filling liquids, such as water and an organic solvent, between the inferior surface of tongue of projection optics, and a substrate front face, forming an immersion field in it, and the wavelength of the exposure light in the inside of a liquid being set to 1/n in air (n being usually 1.2 to about 1.6 at the refractive index of a liquid).
[0004]
[Patent reference 1]
International public presentation/[99th] No. 49504 pamphlet
[0005]
[Problem(s) to be Solved by the Invention]
In the aligner, detection light is projected on a substrate front face from a focal detection system during exposure of a substrate, and, generally detecting a substrate surface location by receiving the reflected light is performed. Although an immersion field is formed between projection optics and a substrate in the immersion aligner based on an immersion method, compared with gases, such as air, the specific heat tends to carry out the temperature change of the liquid greatly. Therefore, detection light's passage of the inside of the liquid of the immersion field which is easy to carry out a temperature change produces possibility that it becomes impossible for the field location on the front face of a substrate to detect correctly in response to the effect of the refractive-index change based on the temperature change of the liquid. Although projecting detection light on the substrate front face of the outside of an immersion field is also considered, in order to detect the field positional information of a projection field with a sufficient precision, it is desirable to project detection light near the projection field. Although location detection on the front face of a substrate can be performed with a sufficient precision even if detection light passes through the inside of a liquid by performing temperature management of a liquid strictly, an equipment configuration is complicated for temperature management.
[0006]
Moreover, although the temperature change (temperature rise) of the liquid of an immersion field is carried out by the exposure of exposure light For example, if the liquid which it was used for exposure of one certain shot field, and carried out the temperature rise remains on a substrate in case two or more shot fields are set up on a substrate and sequential exposure of each of the shot field of these plurality is carried out The refractive index of a liquid is changed in response to said effect of a liquid which carried out the temperature rise, and the liquid used when exposing the next shot field may have a bad influence on the image of a pattern. It becomes impossible in this case, to perform an accurate pattern imprint in the next shot field.
[0007]

This invention is made in view of such a situation, and where an immersion field is formed between projection optics and a substrate, in case exposure processing is carried out, it aims at offering the aligner and the device manufacture approach of controlling the fall of the pattern imprint precision resulting from the temperature change of a liquid. Moreover, this invention aims at offering the aligner and the device manufacture approach of projecting detection light near the projection field and detecting a substrate surface location with a sufficient precision, also when performing immersion exposure.
[0008]
[Means for Solving the Problem]
In order to solve the above-mentioned technical problem, this invention has adopted the configuration of the following matched with drawing 1 shown in the gestalt of operation - drawing 18 .
The aligner (EX) of this invention forms an immersion field (AR2) in the part on a substrate (P) including the projection field (AR1) of projection optics (PL). In the aligner which projects a pattern image on a substrate (P) through the liquid (1) and projection optics (PL) between projection optics (PL) and a substrate (P), and carries out sequential exposure of two or more shot fields (S1-S12) of a substrate (P) In order to form an immersion field (AR2), it is characterized by having the liquid feeder style (10) of projection optics (PL) which is transmitted to the side face near a tip (3) at least, and supplies a liquid (1) on a substrate (P).
[0009]
Since according to this invention it is transmitted to the side face near the tip of projection optics and the liquid was supplied on the substrate, an immersion field can be made small. Therefore, the detection light for detecting the field positional information of a substrate can be projected near the projection field, passing space other than an immersion field (for example, inside of air). Thus, since detection light is a configuration on which it is projected near the projection field on a substrate without passing through the inside of the liquid which is easy to carry out a temperature change, it can detect the field positional information of a substrate with a sufficient precision, without being influenced of the temperature change of a liquid, and can acquire a high pattern imprint precision. Moreover, since an immersion field can be made small, while being able to lessen the amount of liquids arranged on a substrate and being able to stop the amount of the liquid used by this, the effects (resist dissolution etc.) to the substrate (resist) front face of a liquid can be suppressed to the minimum. Moreover, evaporation of a liquid can also be suppressed by lessening the amount of liquids arranged on a substrate, fluctuation of the environments (humidity etc.) where the substrate is set can be suppressed, possibility that the refractive-index change on the optical path of the detection light of various optical detection equipments will arise by this can be controlled, and a desired pattern imprint precision can be acquired.
[0010]
The aligner (EX) of this invention forms an immersion field (AR2) in the part on a substrate (P) including the projection field (AR1) of projection optics (PL). In the aligner which projects a pattern image on a substrate (P) through the liquid (1) and projection optics (PL) between projection optics (PL) and a substrate (P), and carries out sequential exposure of two or more shot fields (S1-S12) of a substrate (P) The liquid feeder style which supplies a liquid (1) on a substrate (P) in order to form an immersion field (AR2) (10), When the liquid (1) used when exposing the 1st shot field on a substrate (P) exposes the 2nd shot field, it is characterized by having the liquid recovery device (20) in which the liquids (1) on a substrate (P) are collected so that it may not go into a projection field (AR1).
[0011]
Since it was made according to this invention to collect so that it may not go into a projection field in case sequential exposure of two or more shot fields on a substrate is carried out when the liquid used when exposing the 1st shot field exposed the 2nd shot field The liquid used when exposing the 2nd shot field is not influenced [which it is used when the 1st shot field is exposed, and is carrying out the temperature rise by the exposure of exposure light] of a liquid, or the effect of the liquid is reduced. Therefore, generating of refractive-index fluctuation of the liquid resulting from the temperature change of a liquid can be controlled, and an accurate pattern imprint can be performed. Moreover, although the liquid used for exposure may be intermingled in the impurity on the front face of a substrate (resist), since it does not go into a projection field when the liquids used when exposing the 1st shot field are collected and the 2nd shot field is exposed, exposure processing can be carried out using a pure liquid about each of each shot field. Moreover, generating of heat fluctuation of the substrate resulting from evaporation of the liquid which remains can be suppressed by collecting immediately the liquids used to one shot field.
Here, the 1st shot field and the 2nd shot field say two shot fields where arbitration continued. Moreover, the liquid used during exposure of the 1st shot field contains the liquid which existed or passed through the projection field in the projection field during exposure of the 1st shot field at least.
[0012]
The aligner (EX) of this invention forms an immersion field (AR2) in the part on a substrate (P) including the projection field (AR1) of projection optics (PL). While projecting a pattern image into a projection field (AR1) through the liquid (1) and projection optics (PL) between projection optics (PL) and a substrate (P) In the aligner which carries out sequential exposure of each of two or more shot fields (S1-S12) on a substrate (P) by moving a substrate (P) to a predetermined scanning direction (X) to a projection field (AR1) The liquid feeder style which supplies a liquid (1) on a substrate (P) in order to form an immersion field (AR2) (10), It has the liquid recovery device (20) in which the liquids (1) on a substrate (P) are collected in parallel to supply of a liquid (1). A liquid recovery device (20) It is characterized by having liquid recovery opening (33A, 34A) which has been left and arranged in the non-scanning direction (Y) which intersects a scanning direction (X) to a projection field (AR1) and which is prolonged in a non-scanning direction (Y).
[0013]
In case according to this invention the liquids used during exposure of a front shot field can be efficiently collected after the exposure and sequential exposure of each of two or more shot fields is carried out, it can stop that the condition that a liquid remains on a substrate arises. Moreover, the detection light for detecting the field positional information of a substrate Although projected in many cases to the predetermined field on the substrate which is along a scanning direction to a projection field (AF field), liquid recovery opening of a liquid recovery device Since it is prepared so that it may be separated and arranged to a projection field in a non-scanning direction and may extend in a non-scanning direction, a liquid recovery device can be arranged in the location which does not interrupt the optical path of detection

light, and, thereby, field positional information detection of the projection field by detection light can be performed smoothly and with high precision.

[0014]

The aligner (EX) of this invention forms an immersion field (AR2) in the part on a substrate (P) including the projection field (AR1) of projection optics (PL). While projecting a pattern image into a projection field (AR1) through the liquid (1) and projection optics (PL) between projection optics (PL) and a substrate (P) In the aligner which carries out sequential exposure of each of two or more shot fields (S1-S12) on a substrate (P) by moving a substrate (P) to a predetermined scanning direction (X) to a projection field (AR1) In the recovery location left to the scanning direction (X) to the projection field (AR1) in parallel to the liquid feeder style (10) which supplies a liquid (1) on a substrate (P), and supply of a liquid (1) in order to form an immersion field (AR2) In order to adjust the physical relationship of the liquid recovery device (20, 31A, 32A) in which the liquids (1) on a substrate (P) are collected, and the image surface and the substrate (P) front face in which a pattern image is formed It has the detection system (60) which detects the field positional information on the front face of a substrate (P), and a detection system (60) is characterized by detecting field positional information between a projection field (AR1) and a recovery location (31A, 32A).

[0015]

Since field positional information detection by the detection system is performed between a projection field and a liquid recovery location according to this invention, the field positional information of a projection field is [/ near the projection field] detectable with a sufficient precision. Here, since it is exposed while a substrate moves to a predetermined scanning direction, the liquid supplied on the substrate from the liquid feeder style does not spread in the migration direction near side on a substrate, and does not form an immersion field. Therefore, since projection of detection light is attained near the projection field on a substrate, without passing through the inside of a liquid, the field positional information of a projection field is detectable with a sufficient precision.

[0016]

The device manufacture approach of this invention is characterized by using the aligner (EX) of the above-mentioned publication. According to this invention, it has the pattern formed in a good pattern precision, and the device which can demonstrate the desired engine performance can be offered.

[0017]

[Embodiment of the Invention]

Hereafter, it explains, referring to a drawing about the aligner of this invention. Drawing 1 is the outline block diagram showing 1 operation gestalt of the aligner of this invention.

The mask stage MST where Aligner EX supports Mask M in drawing 1 The illumination-light study system IL which illuminates the mask M currently supported by the substrate stage PST which supports Substrate P, and the mask stage MST with the exposure light EL It has the control unit CONT which carries out generalization control of the actuation of the projection optics PL which carries out projection exposure of the pattern image of the mask M illuminated with the exposure light EL at the substrate P currently supported by the substrate stage PST, and the whole aligner EX.

[0018]

Moreover, the aligner EX of this operation gestalt is an immersion aligner which applied the immersion method, in order to shorten exposure wavelength substantially, and to make the depth of focus large substantially, while improving resolution, and it is equipped with the liquid feeder style 10 which supplies a liquid 1 on Substrate P, and the liquid recovery device 20 in which the liquids 1 on Substrate P are collected in parallel to supply of the liquid 1 by the liquid feeder style 10. Aligner EX forms the immersion field AR 2 in the part on the substrate P which includes the projection field AR 1 of projection optics PL with the liquid 1 supplied from the liquid feeder style 10, while imprinting the pattern image of Mask M on Substrate P at least. Aligner EX fills between the optical element 2 of the point of projection optics PL, and the front faces of Substrate P with a liquid 1, projects the pattern image of Mask M on Substrate P through the liquid 1 and projection optics PL between this projection optics PL and Substrate P, and, specifically, exposes Substrate P.

[0019]

Here, with this operation gestalt, carrying out a synchronized drive for being suitable (hard flow), as an aligner EX, the case where the scanning aligner (the so-called scanning stepper) which exposes a mutually different pattern [in / for Mask M and Substrate P / a scanning direction] formed in Mask M to Substrate P is used is made into an example, and it explains. Let [the direction which is in agreement with the optical axis AX of projection optics PL] a direction (non-scanning direction) perpendicular to X shaft orientations, Z shaft orientations, and Y shaft orientations be Y shaft orientations for the direction of a synchronized drive of Mask M and Substrate P (scanning direction) in the following explanation in a flat surface perpendicular to Z shaft orientations and Z shaft orientations. Moreover, let the directions of the circumference of the X-axis, a Y-axis, and the Z-axis be thetaX, thetaY, and theta Z direction, respectively. In addition, a "substrate" here contains the reticle the "mask" had the device pattern by which contraction projection is carried out formed on a substrate including what applied the photoresist which is a photosensitive ingredient on the semi-conductor wafer.

[0020]

The illumination-light study system IL illuminates the mask M currently supported by the mask stage MST with the exposure light EL, and has the adjustable field diaphragm which sets up the lighting field on the condensing lens which condenses the exposure light EL from an optical integrator and an optical integrator which equalizes the illuminance of the flux of light injected from the light source for exposure, and the light source for exposure, a relay lens system, and the mask M by the exposure light EL in the shape of a slit. The predetermined lighting field on Mask M is illuminated by the illumination-light study system IL with the exposure light EL of uniform illumination distribution. As an exposure light EL injected from the illumination-light study system IL, vacuum-ultraviolet light (VUV light), such as far-ultraviolet light (DUV light), such as the bright line (g line, h line, i line) of an ultraviolet area, KrF excimer laser light (wavelength of 248nm), etc. which are injected, for example from a mercury lamp, and ArF excimer laser light (wavelength of 193nm), F2 laser beam (wavelength of 157nm), etc. is used. ArF excimer laser light is used in this operation gestalt.

[0021]

that to which a mask stage MST supports Mask M -- it is -- the inside of a flat surface perpendicular to the optical axis AX of projection optics PL, i.e., XY flat surface, -- two-dimensional -- minute to movable and theta Z direction -- it is

pivotable. A mask stage MST is driven with the mask stage driving gears MSTD, such as a linear motor. The mask stage driving gear MSTD is controlled by the control unit CONT. The migration mirror 50 is formed on the mask stage MST. Moreover, the laser interferometer 51 is formed in the location which counters the migration mirror 50. The location of the two-dimensional direction of the mask M on a mask stage MST and an angle of rotation are measured on real time by the laser interferometer 51, and a measurement result is outputted to a control unit CONT. A control device CONT positions the mask M currently supported by the mask stage MST by driving the mask stage driving gear MSTD based on the measurement result of a laser interferometer 51.

[0022]

Projection optics PL carries out projection exposure of the pattern of Mask M for the predetermined projection scale factor beta at Substrate P, it consists of two or more optical elements containing the optical element (lens) 2 prepared in the point by the side of Substrate P, and these optical elements are supported by Lens-barrel PK. In this operation gestalt, the projection scale factor beta of projection optics PL is the contraction system of 1/4 or 1/5. In addition, any of unit systems and an expansion system are sufficient as projection optics PL. Moreover, the optical element 2 of the point of the projection optics PL of this operation gestalt is formed possible [attachment and detachment (exchange)] to Lens-barrel PK, and the liquid 1 of the immersion field AR 2 contacts an optical element 2.

[0023]

Furthermore, near the point of the projection optics PL containing an optical element 2 is formed in the shape of a taper, and the inclination side faces 3 and 3 are formed in each of X shaft-orientations (scanning direction) both sides in near the point of projection optics PL. With this operation gestalt, the optical element 2 prepared in the point of projection optics PL is formed in the shape of a taper, and the inclination side faces 3 and 3 are formed in this optical element 2. In addition, the inclination side faces 3 and 3 may be formed in Lens-barrel PK, and may be continued and formed in Lens-barrel PK and the optical element 2. Moreover, guide plates 4 and 4 are arranged so that each of side faces 3 and 3 may be met. Guide plates 4 and 4 are formed so that it may estrange slightly in side faces 3 and 3 and the location which counters (for example, about 1mm), and a fluid 1 can circulate between a side face 3 and a guide plate 4.

[0024]

The substrate stage PST is equipped with Z stage 52 which holds Substrate P through a substrate holder, X-Y stage 53 which supports Z stage 52, and the base 54 which supports X-Y stage 53 in support of Substrate P. The substrate stage PST is driven with the substrate stage driving gears PSTD, such as a linear motor. The substrate stage driving gear PSTD is controlled by the control unit CONT. By driving Z stage 52, the location in the location (focal location) in Z shaft orientations of the substrate P currently held at Z stage 52 and thetaX, and the direction of thetaY is controlled. Moreover, the location (it is [the image surface of projection optics PL and] the location of an parallel direction substantially) in the XY direction of Substrate P is controlled by driving X-Y stage 53. That is, Z stage 52 controls the focal location and tilt angle of Substrate P, and doubles the front face of Substrate P with the image surface of projection optics PL by the automatic focus method and the auto leveling method, and X-Y stage 53 performs positioning in X shaft orientations and Y shaft orientations of Substrate P. In addition, it cannot be overemphasized that a Z stage and an X-Y stage may be prepared in one.

[0025]

The migration mirror 55 is formed on the substrate stage PST (Z stage 52). Moreover, the laser interferometer 56 is formed in the location which counters the migration mirror 55. The location of the two-dimensional direction of the substrate P on the substrate stage PST and the angle of rotation of theta Z direction are measured on real time by the laser interferometer 56, and a measurement result is outputted to a control unit CONT. A control device CONT positions the substrate P currently supported by the substrate stage PST by driving the substrate stage driving gear PSTD based on the measurement result of a laser interferometer 56. Moreover, Aligner EX is equipped with the focal detection system 60 (refer to drawing 3) for detecting the field positional information of the substrate P front face currently supported by the substrate stage PST. The positional information of the positional information of Z shaft orientations of the substrate P on the substrate stage PST and thetaX, and the direction of thetaY is detected by the focal detection system 60 on real time, and a detection result is outputted to a control unit CONT. A control device CONT performs position control (attitude control) of the substrate P currently supported by the substrate stage PST by driving the substrate stage driving gear PSTD based on the detection result of the focal detection system 60.

[0026]

Moreover, on the substrate stage PST (Z stage 52), the auxiliary plate 57 is formed so that Substrate P may be surrounded. The auxiliary plate 57 has the front face of the substrate P held at the substrate holder, and the flat surface of the almost same height. Here, although an about 1-2mm clearance is between the edge of Substrate P, and the auxiliary plate 57, also when a liquid 1 hardly flows into the clearance with the surface tension of a liquid 1 and it exposes near the periphery of Substrate P, a liquid 1 can be held under projection optics PL with the auxiliary plate 57.

[0027]

Drawing 2 is the outline block diagram showing the liquid feeder style 10 and the liquid recovery device 20. It is what supplies the predetermined liquid 1 on Substrate P in drawing 2 in order that the liquid feeder style 10 may form the immersion field AR 2. The 1st liquid feed zone 11 and the 2nd liquid feed zone 12 which can supply a liquid 1, Supply pipe 11A which has the passage which connected the end section to the 1st liquid feed zone 11, Supply pipe 12A which has the passage which connected the end section to the 2nd liquid feed zone 12, It was formed between the side faces 3 and guide plates 4 near the point of projection optics PL, was formed between the 1st passage 13 which can circulate a liquid 1, and the side face 3 of another side (+X side) and a guide plate 4, and has the 2nd passage 14 which can circulate a liquid 1. [on the other hand / (-X side)] The 1st and 2nd passage 13 and 14 is equipped with the outlet sections 13B and 14B which are the inlet-port sections 13A and 14A and lower limit openings which are upper limit opening, respectively. And the other end of supply pipe 11A is connected to inlet-port section 13A of the 1st passage 13, and the other end of supply pipe 12A is connected to inlet-port section 14A of the 2nd passage 14. moreover, the 1st and 2nd passage 13 and 14 -- each outlet section 13B and 14B approaches the front face of Substrate P, and is arranged. The 1st and 2nd passage 13 and 14 is sent out from each of the 1st and 2nd liquid feed zones 11 and 12, puts in the liquid 1 which passed supply pipes 11A and 12A from the inlet-port sections 13A and 14B, is taking out from the outlet sections 13B and 14B, and supplies a liquid 1 on Substrate P. That is, the liquid feeder style 10 is transmitted to the side face 3 of the point of

projection optics PL, supplies a liquid 1 on Substrate P, still more specifically pours a liquid 1 to the 1st and 2nd passage 13 and 14 formed between side faces 3 and 3 and guide plates 4 and 4, and supplies a liquid 1 on Substrate P. here -- the 1st and 2nd passage 13 and 14 -- each outlet section 13B and 14B is formed in a mutually different location in the direction of a field of Substrate P. Outlet section 13B is prepared in scanning direction one side (-X side) to the projection field AR 1, and, specifically, outlet section 14B is prepared in the other side (+X side). The liquid feeder style 10 can supply a liquid 1 now to coincidence on both sides of the projection field AR 1 by driving the 1st and 2nd liquid feed zones 11 and 12 about X shaft orientations which are directions parallel to a scanning direction through the outlet sections 13B and 14B of the 1st and 2nd passage 13 and 14.

[0028]

Each of the 1st and 2nd liquid feed zones 11 and 12 is equipped with the tank which holds a liquid 1, the booster pump, etc. Liquid supply actuation of the 1st and 2nd liquid feed zones 11 and 12 is controlled by the control unit CONT, and its control unit CONT becomes [, respectively] independent about the liquid amount of supply per [to the substrate P top by the 1st and 2nd liquid feed zones 11 and 12] unit time amount and is controllable.

[0029]

Pure water is used for a liquid 1 in this operation gestalt. Pure water can penetrate not only ArF excimer laser light but far-ultraviolet light (DUV light), such as the bright line (g line, h line, i line) of an ultraviolet area, KrF excimer laser light (wavelength of 248nm), etc. which are injected from a mercury lamp.

[0030]

Moreover, lyophilic-ized processing (hydrophilization processing) which raises compatibility with a liquid 1 is performed to the side face 3 of the projection optics PL which constitutes passage 13 and 14 among the liquid feeder styles 10. In this operation gestalt, since a liquid 1 is water, surface treatment according to compatibility with water is performed to the side face 3. A fluid 1 circulates smoothly by performing lyophilic-ized processing to the side face 3 which constitutes passage 13 and 14.

[0031]

Surface treatment to a side face 3 is performed according to the polarity of a liquid 1. Since the liquid 1 in this operation gestalt is polar large water, it is forming a thin film by matter of the polar large molecular structure, such as alcohol, as hydrophilization processing to a side face 3, and gives a hydrophilic property to this side face 3. Or a hydrophilic property can be given also by performing O2 plasma treatment which carries out plasma treatment, using oxygen (O2) as raw gas as opposed to a side face 3. Thus, when using water as a liquid 1, the processing which arranges on a front face what had the polar large molecular structures, such as an OH radical, in the side face 3 is desirable. Here, the thin film for surface treatment is formed with an undissolved ingredient to a liquid 1. Moreover, lyophilic-ized processing is suitably changed in the processing condition according to the material property of the liquid 1 to be used.

[0032]

In addition, lyophilic-ized processing can perform lyophilic-ized processing also to the guide plate 4 which constitutes not only the side face 3 of projection optics PL but the passage 13 and 14.

[0033]

Drawing 3 is the perspective view showing the outline configuration of the liquid feeder style 10 and the liquid recovery device 20. As shown in drawing 3 , the guide plate 4 is formed in the cross-sectional-view U shape, and is connected to the side face 3. And the slit-like passage 13 and 14 is formed between the side face 3 and the guide plate 4. in addition, the passage 13 and 14 -- each Y shaft-orientations both ends are blockaded by the side face of the guide plate 4 formed in the cross-sectional-view U shape. The liquid 1 which flowed passage 13 and 14 is supplied on Substrate P from the outlet sections 13B and 14B prolonged in Y shaft orientations. Moreover, spacing in X shaft orientations of outlet section 13B and outlet section 14B is set as the almost same value as the magnitude in X shaft orientations of the point of projection optics PL, as a result the magnitude in X shaft orientations of the projection field AR 1. In addition, in drawing 3 , the top face of an optical element 2 is fabricated in the shape of the spherical surface. Moreover, in drawing 3 , although the optical element 2 serves as a configuration with two side faces parallel to XZ flat surface since it is easy, these two side faces are the flat surface which inclined to XZ flat surface in fact, or a curved surface.

[0034]

Moreover, Aligner EX is equipped with the focal detection system 60 for detecting the field positional information of a substrate P front face as shown in drawing 3 . The 1st detection system 61 in which the focal detection system 60 detects field positional information in the predetermined field (the "1st AF field" is called suitably hereafter) AF 1 of scanning direction one side (-X side) to the projection field AR 1 on Substrate P, It has the 2nd detection system 62 which detects field positional information in the predetermined field (the "2nd AF field" is called suitably hereafter) AF 2 of the other side (+X side). The focal detection system 60 (61 62) of this operation gestalt is the so-called oblique incidence method focus detection system, and the 1st detection system 61 is equipped with projection area 61A which projects detection light on the 1st AF field AF 1 from across, and light sensing portion 61B which receives the reflected light reflected in the 1st AF field AF 1. On the other hand, the 2nd detection system 62 equips the 2nd AF field AF 2 with projection area 62A which projects detection light from across, and light sensing portion 62B which receives the reflected light which reflected in the 2nd AF field AF 2. Here, it is arranged in accordance with Y shaft orientations, and, as for projection area 61A and light sensing portion 61B, detection light and its reflected light have an optical path in alignment with Y shaft orientations which are non-scanning directions of Substrate P. Similarly, projection area 62A and light sensing portion 62B are arranged in accordance with Y shaft orientations, and detection light and its reflected light have an optical path in alignment with Y shaft orientations which are non-scanning directions of Substrate P.

[0035]

in addition, although it is alike, it sets and it is projected by three places along the scanning direction (the direction of X), the detection light from projection area 61A of the focal detection system 60 may be projected on two or more [without the 1st AF field AF 1 / along a non-scanning direction (the direction of Y)], and you may make it project it on two or more two-dimensional places in drawing 3 Moreover, you may make it project on one point. Moreover, the location of a projection area or a light sensing portion is not restricted to the location of drawing 3 , either.

[0036]

The detection result of the field positional information of the substrate P by the focal detection system 60 is outputted to

a control unit CONT, and based on the detection result of the focal detection system 60, a control unit CONT is controlling the location and posture of Substrate P on the substrate stage PST through the substrate stage driving gear PSTD, and adjusts the physical relationship of the image surface and the substrate P front face in which the pattern image of projection optics PL is formed.
[0037]
As shown in drawing 2 and drawing 3 , the liquid recovery device 20 in which the liquids 1 on Substrate P are collected The 1st - the 4th liquid stripping sections 21-24 (however, drawing 2 is not [the 4th liquid stripping section] shown), It connected with each of these liquid stripping sections 21-24 through the recovery tubing 21A-24A which has passage, and has the 1st arranged by approaching the front face of Substrate P - the 4th liquid stripping section material 31-34. Each of the 1st - the 4th liquid stripping section material 31-34 has the 1st - the 4th liquid recovery openings 31A-34A suitable for Substrate P side. The liquid stripping sections 21-24 are equipped with aspirators, such as a vacuum pump, the tank which holds the collected liquid 1, and collect the liquids 1 on Substrate P through the liquid stripping section material 31-34 and the recovery tubing 21A-24A. Liquid recovery actuation of the 1st - the 4th liquid stripping sections 21-24 is controlled independently by the control unit CONT, respectively, and its control unit CONT becomes [, respectively] independent about the amount of liquid recovery per unit time amount by the 1st - the 4th liquid stripping sections 21-24 and is controllable.
[0038]
Drawing 4 is the top view showing typically the physical relationship of the 1st - the 4th liquid recovery openings 31A-34A of the 1st - the 4th liquid stripping section material 31-34, and the projection field AR 1 and the 1st and 2nd AF fields AF1 and AF2. As shown in drawing 4 , the projection field AR 1 of projection optics PL is set up in the shape of [which makes a longitudinal direction Y shaft orientations (non-scanning direction)] a rectangle. Although not illustrated to drawing 4 , as mentioned above, moreover, outlet section 13B of the liquid feeder style 10, Each of 14B has the shape of a slit prolonged in Y shaft orientations, and since spacing in X shaft orientations of the outlet sections 13B and 14B is set as the almost same magnitude as the projection field AR 1, the immersion field AR 2 where a liquid 1 is filled is formed in the part on Substrate P so that the projection field AR 1 may be included.
[0039]
Each of the 1st - the 4th liquid recovery openings 31A-34A is prepared in the shape of a rectangle so that it may extend in Y shaft orientations (non-scanning direction), and it has predetermined die length about Y shaft orientations. the 1st - the 4th liquid recovery openings 31A-34A -- the die length in each Y shaft orientations is formed for a long time than the projection field AR 1. Furthermore, it is formed preferably for a long time than the die length (die length in Y shaft orientations of the outlet sections 13B and 14B) in Y shaft orientations of the immersion field AR 2. The 1st and 2nd liquid recovery openings 31A and 32A are arranged about X shaft orientations (scanning direction) at the both sides of the projection field AR 1, and are prepared in the location distant to this projection field AR 1. The 3rd and 4th liquid recovery openings 33A and 34A are arranged at the both sides of the projection field AR 1 about Y shaft orientations (non-scanning direction) which intersect X shaft orientations, and are prepared in the location distant to this projection field AR 1. Specifically 1st liquid recovery opening 31A is prepared in X shaft-orientations one side (-X side) to the projection field AR 1, 2nd liquid recovery opening 32A is prepared in the other side (+X side), 3rd liquid recovery opening 33A is prepared in Y shaft-orientations one side (-Y side), and 4th liquid recovery opening 34A is prepared in the other side (+Y side).
[0040]
The liquid recovery device 20 collects the liquids 1 on Substrate P through the liquid recovery openings 31A-34A by driving the liquid stripping sections 21-24. That is, the installation location of the liquid recovery openings 31A-34A is a recovery location which collects the liquids 1 on Substrate P. By driving the 1st and 2nd liquid stripping sections 21 and 22, the liquid recovery device 20 is the recovery location left to X shaft orientations to the projection field AR 1, and can collect the liquids 1 on Substrate P. Moreover, by driving the 3rd and 4th liquid stripping sections 23 and 24, the liquid recovery device 20 is the recovery location left to Y shaft orientations to the projection field AR 1, and can collect the liquids 1 on Substrate P.
[0041]
As shown in drawing 4 , the 1st AF field AF 1 is set up between the projection field AR 1 and 1st liquid recovery opening 31A, and the 2nd AF field AF 2 is set up between the projection field AR 1 and 2nd liquid recovery opening 32A. That is, in this operation gestalt, the focal detection system 60 (the 1st and 2nd detection systems 61 and 62) detects the field positional information of Substrate P between each of a liquid recovery location and the projection fields AR 1 with the 1st and 2nd liquid recovery openings 31A and 32A.
[0042]
A liquid 1 is arranged in the 1st and 2nd AF fields AF1 and AF2 used at the time of field positional information detection. Namely, as for the AF fields AF1 and AF2 used at the time of field positional information detection of Substrate P, either serves as a non-immersing field.
[0043]
The 3rd and 4th stripping section material 33 and 34 prepared in Y shaft-orientations both sides to the projection field AR 1 makes Y shaft orientations a longitudinal direction. Since it is prepared so that it may stand in a line in accordance with Y shaft orientations to the projection field AR 1, and the width of face of the X shaft orientations is moreover prepared almost similarly to the width of face of the projection field AR 1 Having an optical path in alignment with Y shaft orientations, the detection light on which it is projected to the 1st and 2nd AF fields AF1 and AF2, and its reflected light do not have the optical path interrupted by the liquid stripping section material 31-34.
[0044]
Here, the member to which a liquid 1 circulates at least among each part material which constitutes the liquid feeder style 10 and the liquid recovery device 20 is formed with synthetic resin, such as polytetrafluoroethylene. Thereby, it can control that an impurity is contained in a liquid 1.
[0045]
Next, how to expose the pattern image of Mask M to Substrate P using the aligner EX mentioned above is explained. The aligner EX in this operation gestalt here It is what carries out projection exposure of the pattern image of Mask M at

Substrate P while moving Mask M and Substrate P to X shaft orientations (scanning direction). At the time of scan exposure Some pattern images of Mask M are projected into the projection field AR 1 through the liquid 1 and projection optics PL of the immersion field AR 2, and it synchronizes with Mask M moving in the direction of -X (or the direction of +X) at a rate V. Substrate P moves in the direction of +X (or the direction of -X) by rate beta-V (beta is a projection scale factor) to the projection field AR 1. And as shown in the top view of drawing 5 , on Substrate P, two or more shot fields S1-S12 are set up, and after exposure ending to one shot field, while the next shot field moves to a scan starting position and moves Substrate P by step - and - scanning method hereafter by stepping migration of Substrate P, scan exposure processing to each shot field is performed one by one. In addition, with this operation gestalt, a control unit CONT shall move X-Y stage 53, carrying out the monitor of the output of a laser interferometer 56 so that the optical axis AX of projection optics PL may advance along with the broken-line arrow head 58 of drawing 5 .

[0046]

First, if Substrate P is loaded to the substrate stage PST while Mask M is loaded to a mask stage MST, it faces performing scan exposure processing, and a control unit CONT will drive the liquid feeder style 10, and will start the liquid supply actuation to Substrate P top. After the liquid 1 supplied from each of the 1st and 2nd liquid feed zones 11 and 12 of the liquid feeder style 10 in order to form the immersion field AR 2 circulates supply pipes 11A and 12A, it is supplied on Substrate P through the 1st and 2nd passage 13 and 14, and forms the immersion field AR 2 between projection optics PL and Substrate P. Here, the liquid 1 which circulated supply pipes 11A and 12A spreads crosswise [of the 1st and 2nd passage 13 and 14 formed in the shape of a slit], and is supplied to the large range on Substrate P from the outlet sections 13B and 14B. The liquid 1 supplied on Substrate P from the outlet sections 13B and 14B of the 1st and 2nd passage 13 and 14 is supplied so that it may get wet and spread between the lower limit side of the point (optical element 2) of projection optics PL, and Substrate P, and it forms the immersion field AR 2 in the part on the substrate P including the projection field AR 1. At this time, a control unit CONT supplies the liquid 1 from the both sides of the projection field AR 1 to Substrate P top to coincidence from each of the outlet sections 13B and 14B of the 1st and 2nd passage 13 and 14 arranged among the liquid feeder styles 10 at X shaft-orientations (scanning direction) both sides of the projection field AR 1.

[0047]

In case a liquid 1 is supplied from the scanning direction both sides of the projection field AR 1 to Substrate P, in this operation gestalt a control unit CONT Liquid supply actuation of the 1st and 2nd liquid feed zones 11 and 12 of the liquid feeder style 10 is controlled. The amount of liquids (liquid amount of supply per unit time amount) supplied from the one side of the projection field AR 1 about a scanning direction during scan exposure of one shot field on Substrate P is changed with the amount of liquids supplied from the other side. Specifically, more control units CONT than the liquid amount of supply which supplies the liquid amount of supply per [which is supplied from this side of the projection field AR 1 about a scanning direction] unit time amount in the opposite side are set up.

[0048]

When carrying out exposure processing, moving Substrate P in the direction of +X, for example, a control unit CONT As opposed to the projection field AR 1 the amount of liquids from the -X side (namely, the 1st liquid feed zone 11) + Make [more] it than the amount of liquids from the X side (namely, the 2nd liquid feed zone 12), and on the other hand, when carrying out exposure processing, moving Substrate P in the direction of -X, make [more] the amount of liquids from the +X side to the projection field AR 1 than the amount of liquids from the -X side. thus, the control unit CONT -- the migration direction of Substrate P -- responding -- the 1st and 2nd liquid feed zones 11 and 12 -- the liquid amount of supply per each unit time amount is changed.

[0049]

Moreover, in parallel to the drive of the liquid feeder style 10, a control unit CONT drives the 1st - the 4th liquid stripping sections 21-24 of the liquid recovery device 20, and makes a possible condition recovery actuation of the liquid 1 on Substrate P. A control unit CONT carries out projection exposure of the pattern image of Mask M on Substrate P through the liquid 1 and projection optics PL between projection optics PL and Substrate P, moving the substrate stage PST which supports Substrate P to X shaft orientations (scanning direction) the liquid feeder style 10 and the liquid recovery device 20 recovering the liquid 1 on Substrate P in parallel to supply of the liquid 1 to the front face of Substrate P. Since the liquid feeder style 10 supplies the liquid 1 to coincidence through the 1st and 2nd passage 13 and 14 about the scanning direction from the both sides of the projection field AR 1 at this time, the immersion field AR 2 is formed in homogeneity and fitness.

[0050]

Drawing 6 is the mimetic diagram showing the behavior of the liquid 1 at the time of carrying out exposure processing of the 1st shot field (for example, S2 of drawing 5 , S4, etc.) set up on Substrate P, moving Substrate P in the direction of -X. In drawing 6 , a liquid 1 is supplied to coincidence from passage 13 and 14 to the space between projection optics PL and Substrate P, and the immersion field AR 2 is formed so that this may include the projection field AR 1. The amount of liquids per unit time amount of the liquid 1 supplied here from the passage 14 established in the +X side to the projection field AR 1 - It is mostly set up from the amount of liquids per unit time amount of the liquid 1 supplied from the passage 13 established in the X side, and as the liquid 1 supplied from passage 14 is pulled by the substrate P which moves in the direction of -X, the immersion field AR 2 spreads in the -X side to the projection field AR 1.

[0051]

In case the 1st shot field is exposed moving Substrate P in the direction of -X, in order to detect the field positional information of Substrate P, the 2nd AF field AF 2 by the side of +X is used to the projection field AR 1. Thereby, it passes through the 2nd AF field AF 2 in the projection field AR 1, and the predetermined field on the substrate P which had field positional information detected is arranged. It projects a pattern image into the projection field AR 1, a control unit CONT projecting detection light to the 2nd AF field AF 2, detecting the field positional information of Substrate P based on the light-receiving result in light sensing portion 62B of this reflected light, and controlling the location and the posture of Substrate P through the substrate stage PST based on this field positional information detection result from projection area 62A of the 2nd detection system 62, among the focal detection systems 60.

[0052]

Here, the liquid 1 of the immersion field AR 2 is pulled with migration in the direction of -X of Substrate P at the -X side,

and it flows so that it may drag on to the −X side, as shown in drawing 6 . At this time, a liquid 1 does not spread in the 2nd AF field AF 2, but the 2nd AF field AF 2 can be made into a non-immersing field good. On the other hand, as shown in drawing 6 , the immersion field AR 2 may be formed in a part of 1st AF field AF 1, but the 1st AF field AF 1 is not used for field positional information detection in this case, but since the control unit CONT is performing field positional information detection using the 2nd AF field AF 2 as mentioned above, the field positional information of Substrate P is detectable good.

[0053]

If the exposure to the 1st shot field is completed, a control unit CONT will carry out stepping migration of the substrate P, in order to expose the 2nd shot field (for example, S3, S5, etc. of drawing 5) other than said 1st shot field, while suspending the liquid supply actuation by the liquid feeder style 10. After the scan exposure processing termination to the shot field S2, in order to perform scan exposure processing to the shot field S3 which approached Y shaft orientations to this shot field S2, specifically, a control unit CONT carries out stepping migration between two shot fields S2 on Substrate P, and S3 at Y shaft orientations.

[0054]

Drawing 7 is the mimetic diagram showing the behavior of the liquid 1 at the time of carrying out stepping migration of the substrate P in the direction of −Y. Although parts are collected here through 1st liquid recovery opening 31A prepared in the location left to the projection field AR 1 in the scanning direction among the liquids 1 on Substrate P during the exposure to the 1st shot field, and stepping migration, the remaining parts will be in a residual condition on Substrate P, without being collected by 1st liquid recovery opening 31A. Therefore, during stepping migration, as shown in drawing 7 , the condition of having arranged the liquid 1 arises in Substrate P.

[0055]

And when Substrate P carries out stepping migration in the direction of −Y, the liquid 1 which remained on Substrate P reaches 3rd liquid recovery opening 33A. Thereby, the liquid recovery device 20 can perform recovery of the liquid 1 used at the time of exposure of the 1st shot field during stepping migration of the substrate P after exposure termination of the 1st shot field through 3rd liquid recovery opening 33A. And the 1st shot field (for example, S2) and the 2nd shot field (for example, S3) are close to Y shaft orientations, and the liquid recovery device 20 has the composition of collecting the liquids 1 on Substrate P in the recovery location by 3rd liquid recovery opening 33A left to Y shaft orientations to the projection field AR 1 here. Inconvenient generating of temperature fluctuation of the substrate P by evaporation of the liquid 1 which loses by this the liquid 1 which remains on Substrate P, or is made few and remains etc. can be suppressed.

[0056]

Drawing 8 is the mimetic diagram showing the behavior of the liquid 1 at the time of carrying out exposure processing of the 2nd shot field (for example, S3, S5, etc. of drawing 5) set up on Substrate P, moving Substrate P in the direction of +X. In drawing 8 , a liquid 1 is supplied to coincidence from passage 13 and 14 to the space between projection optics PL and Substrate P, and the immersion field AR 2 is formed so that this may include the projection field AR 1. The amount of liquids per unit time amount of the liquid 1 supplied here from the passage 13 established in the −X side to the projection field AR 1 + Since it is set up more mostly than the amount of liquids per unit time amount of the liquid 1 supplied from the passage 14 established in the X side, as the liquid 1 supplied from passage 13 is pulled by the substrate P which moves in the direction of +X, it is arranged smoothly in the space between projection optics PL and Substrate P.

[0057]

In case the 2nd shot field is exposed moving Substrate P in the direction of +X, in order to detect the field positional information of Substrate P, the 1st AF field AF 1 by the side of −X is used to the projection field AR 1. Thereby, it passes through the 1st AF field AF 1 in the projection field AR 1, and the predetermined field on the substrate P which had field positional information detected is arranged. It projects a pattern image into the projection field AR 1, a control unit CONT projecting detection light to the 1st AF field AF 1, detecting the field positional information of Substrate P based on the light-receiving result in light sensing portion 61B of this reflected light, and controlling the location and the posture of Substrate P through the substrate stage PST based on this field positional information detection result from projection area 61A of the 1st detection system 61, among the focal detection systems 60.

[0058]

Here, the liquid 1 of the immersion field AR 2 is pulled with migration in the direction of +X of Substrate P at the +X side, and it flows so that it may drag on to the +X side, as shown in drawing 8 . At this time, a liquid 1 is not arranged in the 1st AF field AF 1, but the 1st AF field AF 1 can be made into a non-immersing field good. On the other hand, as shown in drawing 8 , the immersion field AR 2 may be formed in a part of 2nd AF field AF 2, but the 2nd AF field AF 2 is not used for field positional information detection in this case, but since the control unit CONT is performing field positional information detection using the 1st AF field AF 1 as mentioned above, the field positional information of Substrate P is detectable good.

[0059]

Although the liquid 1 used at the time of exposure of the 1st shot field at this time may be unable to collect during stepping migration, since this liquid that remained is fully distant from the projection field AR 1 with stepping migration in the direction of −Y of Substrate P, it does not influence exposure of the 2nd shot field. Moreover, in order to expose the 2nd shot field, these liquids 1 that remained are collected by 3rd liquid recovery opening 33A when Substrate P moves in the direction of +X. Thereby, the liquid recovery device 20 can perform remained recovery of the liquid 1 used during exposure of the 2nd shot field at the time of the 1st shot field through 3rd liquid recovery opening 33A. Here, since the magnitude (die length) in Y shaft orientations of liquid recovery opening 33A is set up more greatly than the magnitude in Y shaft orientations of the immersion field AR 2, the liquid recovery device 20 can collect smoothly the liquids 1 on the substrate P used for exposure from liquid recovery opening.

[0060]

By collecting the liquids 1 used as mentioned above at the time of exposure of the 1st shot field during exposure of the 1st shot field, stepping migration of Substrate P, and exposure of the 2nd shot field When the liquid 1 used when the 1st shot field was exposed exposes the 2nd next shot field, the liquid recovery device 20 is collecting the liquids 1 on Substrate P so that it may not go into the projection field AR 1. It can prevent going into the projection field AR 1 in case

it is used by exposure of the 1st shot field and the liquid 1 which is carrying out the temperature rise exposes the 2nd shot field by this, and inconvenient generating of fluctuation of the refractive index of the liquid 1 in the projection field AR 1 resulting from the temperature rise of a liquid 1 etc. can be controlled.
[0061]
By the procedure explained with reference to drawing 6 - drawing 8 , sequential exposure of the shot fields S1-S6 shown in drawing 5 is carried out.
After exposure termination of the shot field (1st shot field) S6 shown in drawing 5 , drawing 9 is the mimetic diagram showing the behavior of the liquid 1 at the time of carrying out train migration (stepping migration) of the substrate P in the direction of -X, in order to move the projection field AR 1 to the shot field (2nd shot field) S7. As shown in drawing 9 , the liquid recovery device 20 can collect recovery of the liquid 1 used at the time of exposure of the shot field S6 during train migration of the substrate P after exposure termination of the shot field S6 through 1st liquid recovery opening 31A. And the 1st shot field S6 and the 2nd shot field S7 are close to X shaft orientations, and the liquid recovery device 20 has the composition of collecting the liquids 1 on Substrate P in the recovery location by 1st liquid recovery opening 31A left to X shaft orientations to the projection field AR 1 here. Since the liquids supplied by liquid recovery opening 31A (or 32A) are collected when this performs stepping migration in **X direction which changes a train, a liquid 1 can suppress inconvenient generating which does not remain on Substrate P but originates in the liquid 1 which remains.
And sequential exposure of the shot fields S7-S12 shown in drawing 5 is again carried out by the procedure explained with reference to drawing 6 - drawing 8 .
[0062]
Since it is transmitted to the side face 3 of the point of projection optics PL and the liquid 1 was supplied on Substrate P as explained above, the immersion field AR 2 can be set up small. Therefore, since the detection light of the focal detection system 60 passes through a non-immersing field and it is projected on it near the projection field AR 1, the focal detection system 60 can improve [precision] field location detection, without being influenced of the temperature change of a liquid 1.
[0063]
And when carrying out sequential exposure of two or more shot fields S1-S12 on Substrate P, Are used when exposing the 1st shot field, the impurity on the front face of a substrate (resist) is intermingled, and since it was made to collect so that it may not go into the projection field AR 1 when the liquid 1 which carried out the temperature rise exposed the 2nd next shot field Accurate exposure processing can be performed also to the 2nd shot field.
[0064]
In addition, it is exposure light (ArF laser pulsed light: of 4kHz, for example, a pulse frequency) during exposure of a shot field. Although Substrate P (mainly a resist, BARC (antireflection film)) is warmed by the exposure of 50ns of pulse width, and power 1.0 W/cm2 and the heat causes a temperature rise in a liquid 1 at the liquid 1 in propagation and the projection field AR 1 Since the liquid 1 is also flowing at the rate of 400 mm/sec extent with migration to the scanning direction (the direction of -X) of a substrate in the scanning direction in scan exposure, it is only that the temperature change of 1-degree-C or less extent arises in the liquid layer of 200nm or less extent on a substrate P front face. The thickness and temperature variation of the liquid which causes about 1mm, then a temperature change for the thickness of the liquid between projection optics PL and a substrate P front face are very slight. Therefore, change of the wave aberration accompanying the temperature change of the liquid 1 in the projection field AR 1 hardly poses a problem to the pattern image projected on Substrate P very small (below 0.1mlambda extent, lambda= 193nm/1.47), either.
[0065]
Moreover, since it has arranged in the location from which each of the liquid recovery openings 33A and 34A of the liquid recovery device 20 was separated to Y shaft orientations to the projection field AR 1, and the configuration was moreover established so that it might extend in Y shaft orientations When projecting on the AF fields AF1 and AF2 from which the detection light of the focal detection system 60 was separated to X shaft orientations to the projection field AR 1, The stripping section material 33 and 34 of the liquid recovery device 20 can be arranged in the location which does not interrupt the optical path of detection light, and, thereby, field positional information detection of the projection field AR 1 by detection light can be performed smoothly and good.
[0066]
Moreover, since the AF fields AF1 and AF2 used in case the field positional information of Substrate P is detected are formed between the liquid recovery locations which are the projection field AR 1 and an installation location of liquid recovery opening, the field positional information of the substrate P arranged in the projection field AR 1 [near the projection field AR 1] is detectable with a sufficient precision.
[0067]
Moreover, since the liquid feeder style 10 supplied the liquid 1 from the scanning direction both sides of the projection field AR 1 through the 1st and 2nd passage 13 and 14, as the supplied liquid 1 is pulled by the substrate P which moves to a scanning direction, since it is damp and spreads to the projection field AR 1, it can form the immersion field AR 2 smoothly so that the projection field AR 1 may be included. And since it makes [more / with this operation gestalt] than the amount of liquids which supplies the amount of liquids which the liquid feeder style 10 supplies from this side of the projection field AR 1 about a scanning direction in the opposite side, as it flows along the migration direction of Substrate P as the liquid 1 supplied on Substrate P is pulled by the substrate P which moves, and it is drawn in the space between projection optics PL and Substrate P, it is arranged smoothly. Therefore, even if the supply energy is small, between projection optics PL and Substrate P, the liquid 1 supplied from the liquid feeder style 10 is arranged smoothly, and can form the immersion field AR 2 good. and a scanning direction -- responding -- the 1st and 2nd passage 13 and 14 -- respectively -- since -- also when the direction where a liquid 1 flows can be changed by changing the amount of liquids to supply and this scans Substrate P in the which direction of the direction of +X, or the direction of -X, the immersion field AR 2 can be smoothly formed between projection optics PL and Substrate P, and high resolution and the large depth of focus can be obtained.
[0068]
In addition, in this operation gestalt, although the liquid feeder style 10 has suspended supply of a liquid 1 at the time of stepping migration of Substrate P Until a series of exposure processing actuation about one substrate P including the

time of stepping migration is completed (until Substrate P is loaded to the substrate stage PST, the exposure processing to all the shot fields S1-S12 is completed and an unload is carried out from the substrate stage PST) Supplying a liquid 1 may be continued. The latency time after starting supply of a liquid 1 until the immersion field AR 2 is formed can be shortened by this, and high throughput-ization can be attained. Moreover, generating of the liquid vibration (the so-called water hammer phenomenon) accompanying ON-OFF of supply can be controlled. In addition, even if a liquid 1 continues being supplied during stepping migration, since it is always driving, the liquid recovery device 20 can collect smoothly the liquids 1 which are going to flow into the outside of the projection field AR 1. In case it continues supplying a liquid 1 until a series of exposure processings about one substrate P are completed here, the liquid feeder style 10 may change the liquid amount of supply under stepping migration of Substrate P to the liquid amount of supply per unit time amount under exposure to a shot field. Specifically, the liquid feeder style 10 reduces the liquid amount of supply per unit time amount of a under [stepping migration of Substrate P] from the liquid amount of supply under scan exposure of a shot field. The liquid amount of supply to the substrate P of a under [the stepping migration which does not contribute to exposure processing] is stopped by this, and the amount of the liquid used in the whole exposure processing can be stopped. thus, the liquid feeder style 10 -- migration actuation (stepping migration or scan migration) of Substrate P -- responding -- the 1st and 2nd liquid feed zones 11 and 12 — you may make it change the liquid amount of supply per each unit time amount

[0069]

Moreover, although the liquid used during exposure of the 1st shot field according to the liquid recovery device 20 is performing liquid recovery so that it may not enter to the projection field AR 1 during exposure of the next 2nd shot field, you may make it devise the moving trucking under stepping migration of Substrate P in this operation gestalt, so that liquid recovery of the liquid recovery device 20 may be performed more smoothly. For example, what is necessary is to move Substrate P or just to lengthen the migration length and transit time in stepping of Substrate P toward the location of liquid recovery opening of the liquid recovery device 20, after exposure termination of the 1st shot field. Moreover, the liquid which continued supply of a liquid from the liquid feeder style 10 after exposure termination of the 1st shot field, and was used during exposure of the 1st shot field is extruded from the projection field AR 1 (it keeps away), and it is good even if like. You may make it adjust the amount of supply and the supply location of a liquid at this time.

[0070]

In addition, although it is made [more] with this operation gestalt than the amount of liquids which supplies the amount of liquids supplied from this side about a scanning direction in the opposite side in case a liquid 1 is supplied from the scanning direction both sides of the projection field AR 1, you may make it supply the liquid 1 of tales doses to coincidence from the both sides of the projection field AR 1. The force of joining the tip side faces 3 and 3 of projection optics PL can be made balance by this, and projection of a good pattern image can be expected. On the other hand, the amount of the liquid 1 used can be stopped by changing the amount of liquids supplied from the scanning direction both sides of the projection field AR 1 according to a scanning direction, continuing supplying a liquid 1.

[0071]

in addition, with this operation gestalt, the 1st and 2nd passage 13 and 14 should excite the liquid feeder style 10, although the liquid 1 is supplied to coincidence from **** For example, in case the liquid supply from the 2nd passage 14 is suspended, a liquid 1 is supplied only from the 1st passage 13, in case scan migration of the substrate P is carried out at the +X side, and scan migration of the substrate P is carried out at the -X side, you may be the configuration which suspends the liquid supply from the 1st passage 13, and supplies a liquid 1 only from the 2nd passage 14.

[0072]

In addition, although the guide plate 4 is provided with this operation gestalt so that the side face 3 of the point of projection optics PL may be met, this guide plate 4 may not exist. By lyophilic--ization-processing a side face 3, the liquid 1 supplied to the side face 3 from the liquid feed zone and the supply pipe is held on a side face 3, is transmitted to this side face 3, and can supply it near the projection field AR 1 on Substrate P. On the other hand, by forming a guide plate 4, lyophilic [of a side face 3] is not enough by having changed the liquid 1 to be used, and even if the condition that a side face 3 cannot hold a liquid 1 arises, it can prevent that the liquid 1 in the middle of being transmitted to the side face 3 falls on Substrate P. Therefore, generating of the exposure nonuniformity resulting from the liquid 1 which fell, and the effect of the resist on Substrate P can be controlled. Moreover, even if it does not lyophilic--ization-process a side face 3 by forming a guide plate 4, a liquid 1 can be smoothly supplied near the projection field AR 1 on Substrate P.

[0073]

In addition, although this operation gestalt explained that lyophilic-ized processing was performed to the side face 3 and guide plate 4 which constitute the 1st and 2nd passage 13 and 14, lyophilic-ized processing can be performed also to the front face of the passage where a liquid 1 flows among the liquid recovery devices 20. Liquid recovery can be smoothly performed by performing lyophilic-ized processing to the liquid stripping section material of the liquid recovery device 20 especially. Or lyophilic-ized processing can be performed also to the apical surface of projection optics PL which a liquid 1 contacts. In addition, since it is what is arranged on the optical path of the exposure light EL when forming a thin film in the apical surface of projection optics PL, it is formed with the ingredient which has permeability to the exposure light EL, and the thickness is also set as extent which can penetrate the exposure light EL.

[0074]

In addition, surface treatment may be performed also according to the compatibility with a liquid 1 or the front face of Substrate P.

[0075]

In addition, the thin film for surface treatment may be monolayer, and may be film which consists of two or more layers. Moreover, the ingredient of arbitration can be used if the formation ingredient is also ingredients which can demonstrate the desired engine performance, such as a metal, metallic compounds, and the organic substance.

[0076]

In addition, although this operation gestalt explained that the 1st and 2nd liquid feed zone was prepared about each of the 1st and 2nd passage 13 and 14, a liquid feed zone is set to one and you may make it connect supply pipes 11A and 12A to this one liquid feed zone. In this case, a valve can be prepared in each of supply pipes 11A and 12A, and the liquid amount of supply to Substrate P can be adjusted to a mutually different value from the 1st and 2nd passage 13 and 14 by

adjusting the opening of a valve. Similarly, although the liquid stripping sections 21-24 are formed about each of the liquid stripping section material 31-34 with this operation gestalt, you may be the configuration of setting a liquid stripping section to one and connecting this one liquid stripping section and two or more liquid stripping section material with recovery tubing.

[0077]

In addition, with this operation gestalt, although the side face 3 (passage 13 and 14) of projection optics PL explained that it was prepared in scanning direction both sides, it may be established in the non-scanning direction.

[0078]

In addition, as for the liquid feed zones 11 and 12 and the liquid stripping sections 21 and 22, it is desirable to be supported by supporter material other than the supporter material which supports projection optics PL and this projection optics PL. Thereby, vibration generated by actuation of the pump accompanying supply and recovery of a liquid etc. can prevent what is transmitted to projection optics PL.

[0079]

Hereafter, other operation gestalten of this invention are explained. in the following explanation, the sign same about a component the same as that of the operation gestalt mentioned above or equivalent is attached here, and simple in the explanation -- or it omits.

Drawing 10 is the mimetic diagram showing other examples of arrangement of liquid recovery opening of a liquid recovery device. As shown in drawing 10 , the liquid recovery openings 33B and 33C which inclined about the Y-axis, and the liquid recovery openings 34B and 34C are formed in Y shaft-orientations both sides to the projection field AR 1, respectively. Here, the liquid stripping section material which has the liquid recovery openings 33B, 33C, 34B, and 34C is prepared in the location which does not interrupt the optical path of the detection light of a focal detection system. Thus, with the projection field AR 1, it is parallel, and stands in a line, and liquid recovery opening prepared in Y shaft orientations to the projection field AR 1 does not need to be prepared, and may be prepared in the location shifted to the projection field AR 1. By preparing in the location shifted to the projection field AR 1, or inclining and preparing liquid recovery opening, the liquids 1 used at the time of exposure of the 1st shot field during stepping migration of the substrate P after exposure termination of the 1st shot field can be collected more efficiently. That is, although the case where the liquids 1 on Substrate P all cannot be collected during stepping migration will arise as explained with reference to drawing 7 etc. if liquid recovery opening 33A (34A) makes the longitudinal direction in agreement with Y shaft orientations and it is arranged together with the projection field AR 1 As shown in drawing 10 , the liquid 1 on the substrate P used by exposure of the 1st shot field during stepping migration is all recoverable by preparing liquid recovery opening so that it may incline about a Y-axis.

[0080]

Drawing 11 and drawing 12 are drawings showing other operation gestalten of liquid recovery opening. As shown in drawing 11 , you may be two or more liquid recovery opening (liquid stripping section material) 31D--, 32D--, 33D--, and the configuration that arranges 34D-- intermittently. Moreover, as shown in drawing 12 , liquid recovery opening (liquid stripping section material) may be a configuration surrounding the projection field AR 1 and the AF fields AF1 and AF2. Although liquid recovery opening 31K shown in drawing 12 are formed in the shape of a plane view rectangle so that the projection field AR 1 and the AF fields AF1 and AF2 may be surrounded, you may be except the shape of a rectangle (for example, circle configuration). Liquid recovery can be ensured by preparing liquid recovery opening so that the projection field AR 1 and the AF fields AF1 and AF2 may be surrounded. In addition, the liquid stripping section material which constitutes liquid recovery opening in this case is prepared in the location which does not bar the optical path of the detection light of the focal detection system 60.

[0081]

although the above-mentioned operation gestalt explained that the side face 3 of projection optics PL was a flat side (the shape of a cross-sectional-view straight line), it is shown in drawing 13 -- as -- a side face 3 -- receiving -- surface area expansion processing -- surface roughening may specifically be performed. Since the surface area of a side face 3 is expanded and the maintenance to fitness is much more attained in a liquid 1 by carrying out surface roughening, even if it does not form a guide plate 4, a liquid 1 can be smoothly supplied on Substrate P.

Moreover, a side face 3 may be a curved surface-like. specifically, it is shown in drawing 14 -- as -- a side face 3 -- cross sectional view, the shape of for example, a secondary curve, -- or it may be circular. Even if it is such a configuration, circulation becomes possible good about a liquid 1. The time amount to which a fluid 1 reaches outlet section 13B (14B) from inlet-port section 13A (14A) can be shortened by making a side face 3 into the shape of a cycloid curve especially. Here, as for a side face 3, it is desirable that it is the curved surface which swells outside to the center section (optical axis) of projection optics PL.

And lyophilic-ized processing can be performed also to the side face 3 shown in drawing 13 or drawing 14 .

[0082]

Moreover, although the twin stage mold aligner which carried two stages holding Substrate P has appeared in recent years, this invention is applicable also to a twin stage mold aligner.

Drawing 15 is the outline block diagram of the twin stage mold aligner EX2. The twin stage mold aligner EX2 is equipped with the independently movable respectively 1st and 2nd substrate stages PST1 and PST2 for the common base 71 top. Moreover, the twin stage mold aligner EX2 has the exposure station A and measurement / exchange station B, and all the systems of drawing 1 are carried in the exposure station A except for the focal detection system 60. Moreover, the focal detection system 60 which has projection area 60A and light sensing portion 60B is carried in measurement / exchange station B.

[0083]

As fundamental actuation of such a twin stage mold aligner EX2, exchange and measurement processing of the substrate P on the 1st substrate stage PST 1 are performed at measurement / exchange station B at the exposure station A during exposure processing of the substrate P on the 2nd substrate stage PST 2, for example. And after each activity is completed, the 2nd substrate stage PST 2 moves to measurement / exchange station B, the 1st substrate stage PST 1 moves to the exposure station A in parallel to it, measurement and the message exchange are shortly performed on the 2nd substrate stage PST 2, and exposure processing is performed to the substrate P on the 1st substrate stage PST 1.

[0084]
That is, the field positional information of Substrate P is detected by the focal detection system 60 at measurement / exchange station B, and this detection result is memorized by the control unit CONT. A control unit CONT moves the substrate P which had field positional information detected to the exposure station A, and it carries out exposure processing, adjusting the physical relationship of the image surface of projection optics PL, and the front face of Substrate P based on said memorized field positional information.
[0085]
Thus, in the case of the twin stage mold aligner EX2, since it is possible to consider as the configuration which does not form the focal detection system 60 in the exposure station A, the degree of freedom of the installation location of liquid stripping section material can be increased. Therefore, as shown in drawing 16 , at the exposure station A, liquid stripping section material (liquid recovery opening) can be prepared in near from that of the projection field AR 1, and liquid recovery actuation can be performed smoothly. The liquid recovery openings 31E and 32E shown in drawing 16 are formed in a plane view U shape, respectively, are arranged at the scanning direction both sides of the projection field AR 1, and they are prepared so that the projection field AR 1 may be surrounded. Thereby, a liquid recovery device can perform liquid recovery good in each under scan exposure and stepping migration through these liquid recovery openings 31E and 32E.
[0086]
In addition, when preparing a focal detection system in the exposure station A, as shown in drawing 17 , the AF fields AF1 and AF2 can be set to the outside of the liquid recovery openings 31E and 32E to the projection field AR 1.
[0087]
As mentioned above, the liquid 1 in this operation gestalt is constituted by pure water. Pure water has an advantage without the bad influence to a photoresist, an optical element (lens), etc. on Substrate P while being able to come to hand in large quantities easily by a semi-conductor plant etc. Moreover, since the content of an impurity is very low, pure water can also expect the operation which washes the front face of Substrate P, and the front face of an optical element established in the apical surface of projection optics PL, while not having a bad influence to an environment. And since the refractive index n of the pure water(water) to the exposure light EL whose wavelength is about 193nm is about 1.47, when ArF excimer laser light (wavelength of 193nm) is used as the light source of the exposure light EL, on Substrate P, it is short-wavelength-ized by 1/n, i.e., about 131nm, and high resolution is obtained. Furthermore, when what is necessary is just to be able to secure the depth of focus comparable as the case where it is used in air since the depth of focus is expanded [be / it / under / air / comparing] to about n times, i.e., about 1.47 times, it can make the numerical aperture of projection optics PL increase more, and its resolution improves also at this point.
[0088]
With this operation gestalt, the lens is attached at the tip of projection optics PL as an optical element 2, and this lens can perform the optical property of projection optics PL, for example, adjustment of aberration (spherical aberration, comatic aberration, etc.).
[0089]
In addition, when the pressure between the optical elements at the tip of projection optics PL and Substrates P which are produced by the flow of a liquid 1 is large, the optical element may not be made exchangeable, but you may fix strongly so that an optical element may not move with the pressure.
[0090]
In addition, although the liquid 1 of this operation gestalt is water, since this F2 laser beam does not penetrate water when the light source of for example, the exposure light EL which may be liquids other than water is F2 laser, you may be fluorine system fluids, such as for example, fluorine system oil which can penetrate F2 laser beam as a liquid 1. In this case, into the part in contact with the liquids 1 including a side face 3, it lyophilic--ization-processes by forming a thin film by the matter of the polar small molecular structure containing a fluorine. Moreover, if it considers as a liquid 1, there is permeability over the exposure light EL, a refractive index is high as much as possible, and it is also possible to use a stable thing (for example, cedar oil) to the photoresist applied to projection optics PL and a substrate P front face. Also in this case, surface treatment is performed according to the polarity of the liquid 1 to be used.
[0091]
In addition, as a substrate P of each above-mentioned operation gestalt, not only the semi-conductor wafer for semiconductor device manufacture but the glass substrate for display devices, the mask used with the ceramic wafer for the thin film magnetic heads or an aligner or the original edition (synthetic quartz, silicon wafer) of a reticle, etc. is applied.

[0092]
It is applicable also to the projection aligner (stepper) of the step-and-repeat method which one-shot exposure of the pattern of Mask M is carried out [method] in the condition of having stood still Mask M and Substrate P other than the scanning aligner (scanning stepper) of step - which carries out the synchronized drive of Mask M and the substrate P, and carries out scan exposure of the pattern of Mask M as an aligner EX, and - scanning method, and carries out step migration of the substrate P one by one. Moreover, this invention can apply at least two patterns also to the aligner of step - imprinted in piles partially and - SUTITCHI method on Substrate P.
[0093]
As a class of aligner EX, it is not restricted to the aligner for semiconductor device manufacture which exposes a semiconductor device pattern to Substrate P, but can apply to the aligner for manufacturing an aligner, the thin film magnetic head, an image sensor (CCD), a reticle or a mask for the object for liquid crystal display component manufacture, or display manufacture, etc. widely.
[0094]
When using a linear motor (USP5,623,853 or USP5,528,118 reference) for the substrate stage PST and a mask stage MST, whichever of the magnetic levitation mold using the air surfacing mold and the Lorentz force, or the reactance force which air bearing was used may be used. Moreover, the type which moves along with a guide is sufficient as each stages PST and MST, and they may be guide loess types which do not prepare a guide.
[0095]

The flat-surface motor which the magnet unit which has arranged the magnet to two dimensions, and the armature unit which has arranged the coil to two dimensions are made to counter as a drive of each stages PST and MST, and drives each stages PST and MST according to electromagnetic force may be used. In this case, what is necessary is to connect either of a magnet unit and an armature unit to Stages PST and MST, and just to establish another side of a magnet unit and an armature unit in the migration side side of Stages PST and MST.
[0096]
The reaction force generated by migration of the substrate stage PST may be mechanically missed to the floor (earth) using a frame member as indicated by JP,8-166475,A (USP5,528,118), so that it may not get across to projection optics PL.
The reaction force generated by migration of a mask stage MST may be mechanically missed to the floor (earth) using a frame member as indicated by JP,8-330224,A (US S/N 08/416,558), so that it may not get across to projection optics PL.
[0097]
as mentioned above, the aligner EX of this application operation gestalt -- this application -- it is manufactured by assembling the various subsystems containing each component mentioned to the claim so that a predetermined mechanical precision, electric precision, and optical precision may be maintained. In order to secure these various precision, before and after this assembly, adjustment for attaining electric precision is performed about the adjustment for attaining mechanical precision about the adjustment for attaining optical precision about various optical system, and various mechanical systems, and various electric systems. Like the assembler from various subsystems to an aligner, the mechanical connections between [various] subsystems, wiring connection of an electrical circuit, piping connection of an atmospheric-pressure circuit, etc. are included. It cannot be overemphasized that it is in the front like the assembler from these various subsystems to an aligner like the assembler of each subsystem each. If it ends like the assembler to the aligner of various subsystems, comprehensive adjustment will be performed and the various precision as the whole aligner will be secured. In addition, as for manufacture of an aligner, it is desirable to carry out in the clean room where temperature, an air cleanliness class, etc. were managed.
[0098]
As micro devices, such as a semiconductor device, are shown in drawing 18 With the aligner EX of step 201 which performs the function and engine-performance design of a micro device, step 202 which manufactures the mask (reticle) based on this design step, step 203 which manufactures the substrate which is the base material of a device, and the operation gestalt mentioned above It is manufactured through the exposure processing step 204 which exposes the pattern of a mask to a substrate, the device assembly step (a dicing process, a bonding process, and a package process are included) 205, and inspection step 206 grade.
[0099]
[Effect of the Invention]
Where an immersion field is formed between projection optics and a substrate, in case exposure processing is carried out according to this invention, the optical path of the detection light for detecting the field positional information of a substrate can be prepared in a non-immersing field. Therefore, the field positional information of a substrate can be detected with a sufficient precision, and a highly precise pattern imprint precision can be acquired. Moreover, since it was made to collect so that it may not go into a projection field in case sequential exposure of two or more shot fields on a substrate is carried out when the liquid used when exposing the 1st shot field exposed the 2nd shot field The liquid used when exposing the 2nd shot field can perform accurate exposure processing, without being influenced [which it is used when the 1st shot field is exposed, and is carrying out the temperature rise by the exposure of exposure light] of a liquid.

[Brief Description of the Drawings]
[Drawing 1] It is the outline block diagram showing 1 operation gestalt of the aligner of this invention.
[Drawing 2] It is drawing showing the outline configuration of the liquid feeder style which is the important section enlarged drawing of drawing 1 , and is the characteristic part of this invention, and a liquid recovery device.
[Drawing 3] It is the perspective view showing the outline configuration of the liquid feeder style which is the characteristic part of this invention, and a liquid recovery device.
[Drawing 4] It is the top view showing typically the physical relationship of a projection field and AF field, and liquid recovery opening.
[Drawing 5] It is drawing showing the shot field set up on the substrate.
[Drawing 6] It is the mimetic diagram showing the behavior of the liquid under exposure actuation.
[Drawing 7] It is the mimetic diagram showing the behavior of the liquid under exposure actuation.
[Drawing 8] It is the mimetic diagram showing the behavior of the liquid under exposure actuation.
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[Drawing 18] It is the flow chart Fig. showing an example of the production process of a semiconductor device.
[Description of Notations]
1 [-- Liquid feeder style,] -- A liquid, 3 -- A side face, 4 -- A guide plate, 10
11 12 -- A liquid feed zone, 13 -- The 1st passage, 14 -- The 2nd passage,
20 -- A liquid recovery device, 21-24 -- A liquid stripping section, 31-34 -- Liquid stripping section material,
31A-34A -- Liquid recovery opening, 60 -- A focal detection system, AR1 -- Projection field,
AR [-- Mask,]2 -- An immersion field, CONT -- A control unit, EX -- An aligner, M

P -- A substrate, PL -- Projection optics, S1-S12 -- Shot field

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[Translation done.]

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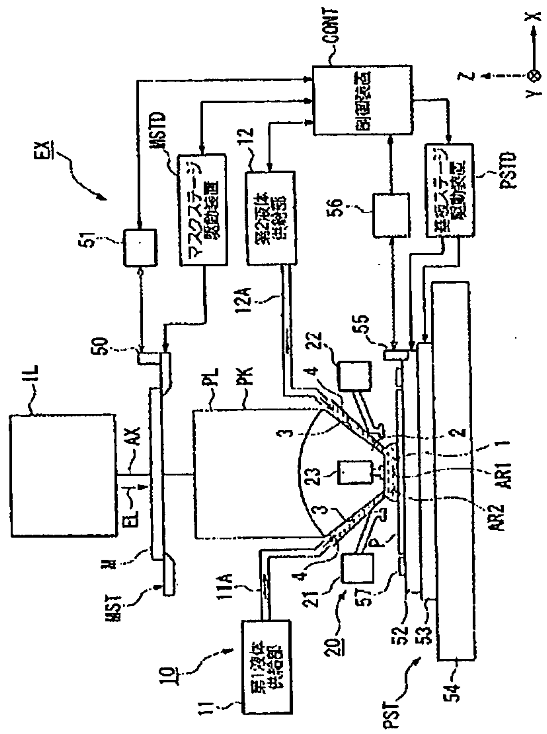
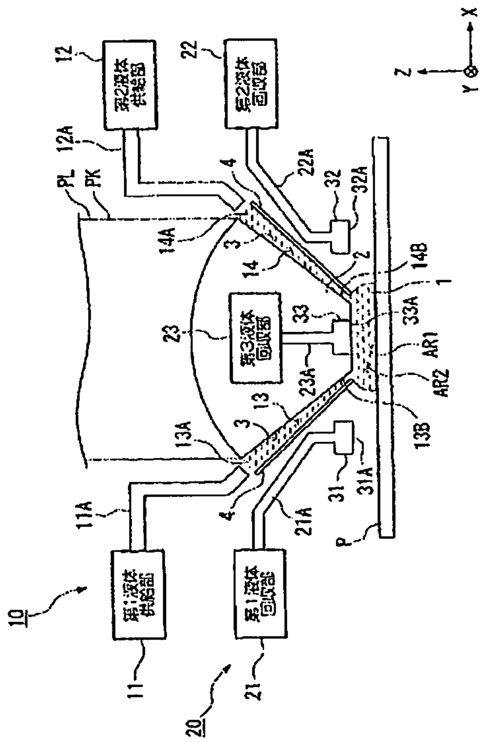
DRAWINGS

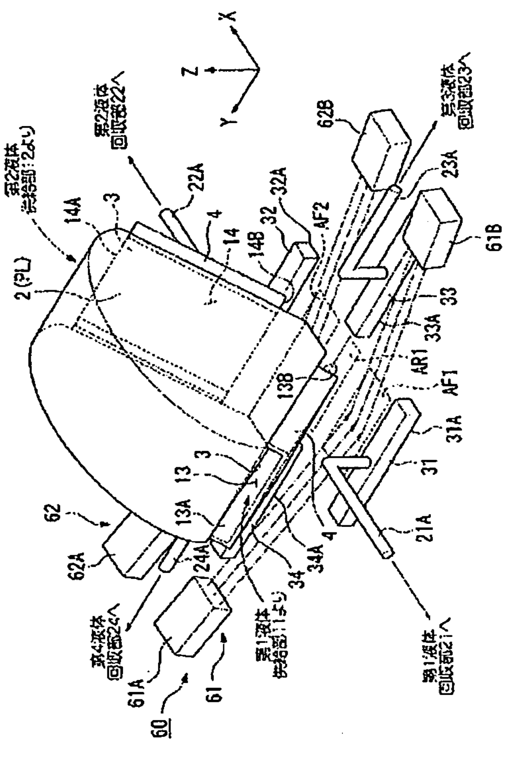
[Drawing 1]



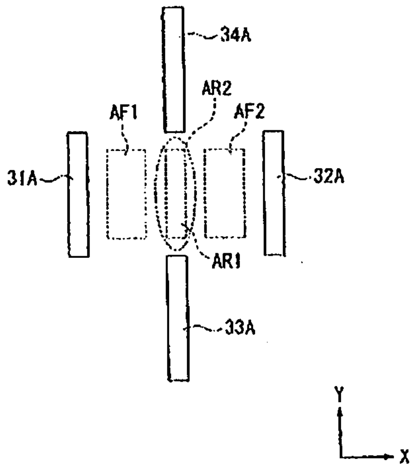
[Drawing 2]



[Drawing 3]



[Drawing 4]



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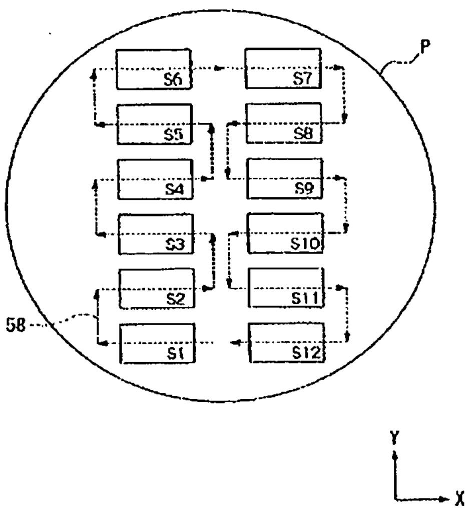

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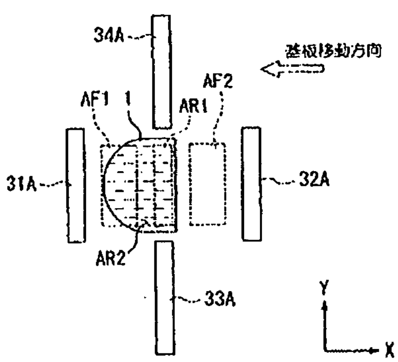

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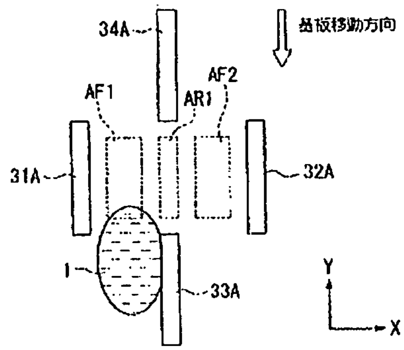
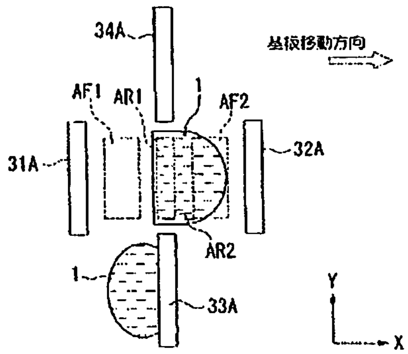
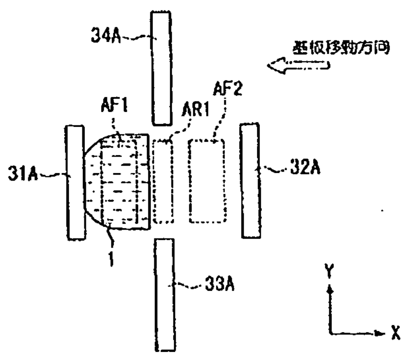


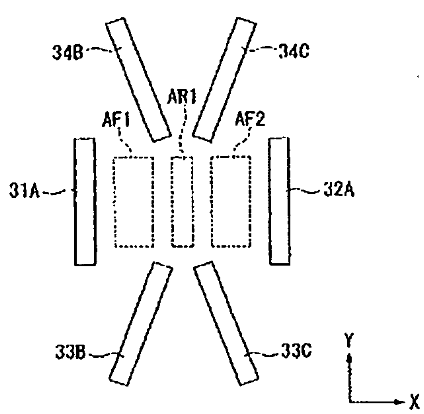
[Drawing 8]



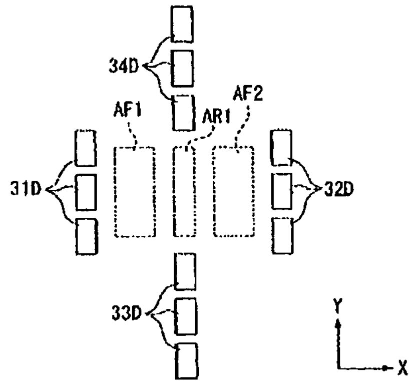
[Drawing 9]



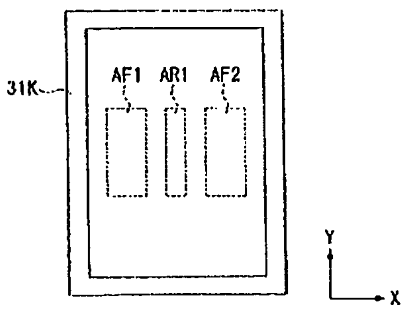
[Drawing 10]



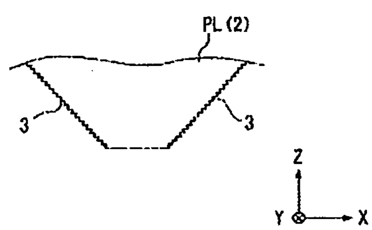
[Drawing 11]



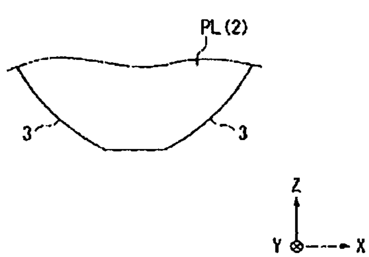
[Drawing 12]



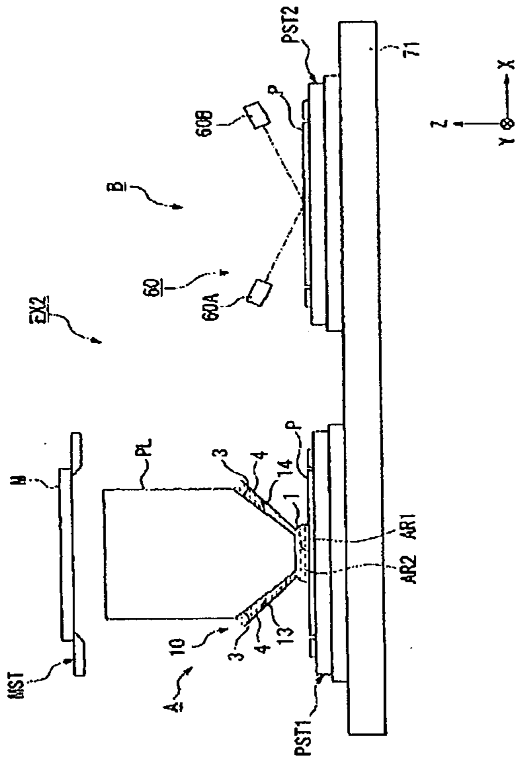
[Drawing 13]



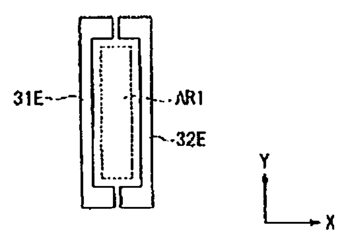
[Drawing 14]



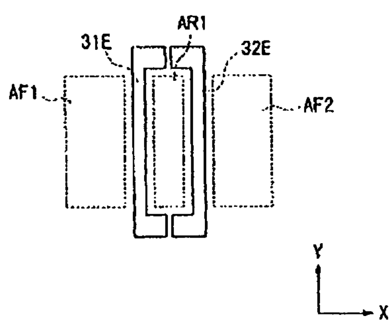
[Drawing 15]



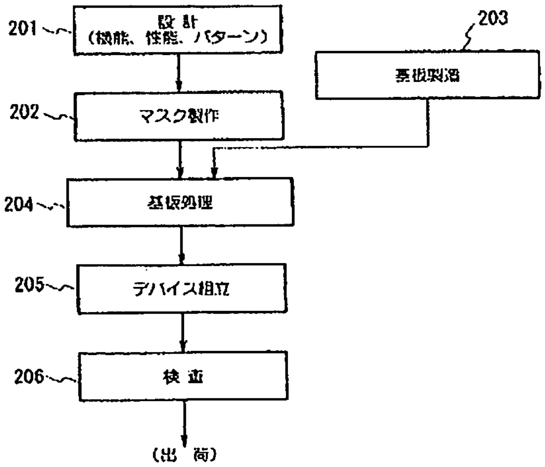
[Drawing 16]



[Drawing 17]



[Drawing 18]



[Translation done.]